PATENT ABSTRACTS OF JAPAN

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(54) INK SET FOR INK JET RECORDING AND RECORDING

(57)Abstract:

PROBLEM TO BE SOLVED: To prevent bleeding of color mixture due to flow of ink between black ink and color ink and obtain the subject ink capable of providing sharp and vivid color image by specifying moving ratio of each dye in ink by paper chromatography.

SOLUTION: In ink set for ink jet recording comprising ink for recording having N colors forming image on a material to be recorded, moving ratio (Rf value) of dye contained in ink for each recording having ≥(N-1) colors in ink set for ink jet recording is controlled to 0.5-0.8 and further, inorganic value/organic value (I/O value) of dyes in ink for each recording is at least 1-3 or difference of I/O value of each dye is at least ≤6 or difference between I/O value of ink liquid after removing dye from ink and I/O value of dye is at least ≥0.8 or difference between I/O value of dye and I/O value of the material to be recorded is at least within 0.3 or when the material to be recorded is paper, I/O value of dye is preferably at least 2.3-3.1.

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* NOTICES *

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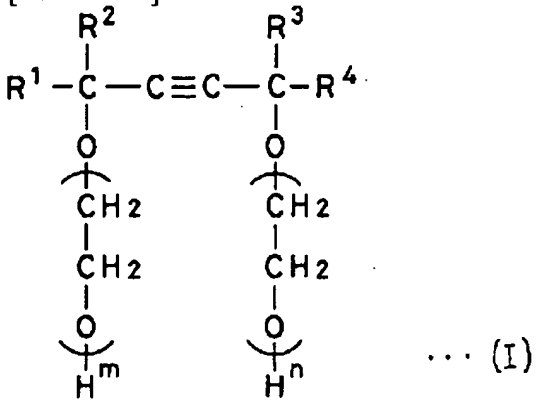
CLAIMS

[Claim(s)]
[Claim 1] The ink set for ink jet record characterized by the movement ratio (Rf value) of the color contained among the ink for record of said N color in said each ink for record more than a color (N-1) being 0.5 to 0.8 in the ink set for ink jet record which becomes a recorded material from the ink for record of N color which forms an image.
[Claim 2] The ink set for ink jet record according to claim 1 characterized by the inorganic nature / organic value of the color contained in each ink for record (I/O value) being at least 1.0 to 3.0.
[Claim 3] The ink set for ink jet record according to claim 1 characterized by the difference of the I/O value of said color being less than in at least 0.6.
[Claim 4] The ink set for ink jet record according to claim 1 characterized by the difference of the I/O value of ink water and the I/O value of a color excluding the color from the inside of said ink for record being at least 0.8 or more.
[Claim 5] The ink set for ink jet record according to claim 1 characterized by coming to include polyhydric-alcohol low-grade alkyl ether the acetylene glycol of the following formula (I) 0.5 to 1.2% of the weight in said ink for record seven to 12% of the weight at least coming [water, a color, a hydrophilic quantity boiling point low volatile solvent, polyhydric-alcohol low-grade alkyl ether, and the acetylene glycol expressed with the following type (I)].
[Formula 1]



... (I)

(Here, R1, R2, R3, and R4 express C1-6 alkyl group independently, respectively, and n+m expresses 0-30.)
[Claim 6] The ink set for ink jet record according to claim 1 characterized by including the acetylene glycol of said formula (I) for polyhydric-alcohol low-grade alkyl ether 0.5 to 2% of the weight seven to 10% of the weight in said ink for record.
[Claim 7] The ink set for ink jet record according to claim 1 characterized by including a hydrophilic quantity boiling point low volatile solvent 50% of the weight or more on polyhydric-alcohol low-grade alkyl ether criteria in said ink for record.

[Claim 8] The record approach characterized by being the record approach which forms an image in a recorded material using the ink set for ink jet record according to claim 1, and the difference of the I/O value of the color in the ink for record and the I/O value of a recorded material being less than at least 0.3.
[Claim 9] The record approach according to claim 8 characterized by the I/O value of said color being at least 2.3 to 3.1 when said recorded material is paper (cellulose).

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the ink set for record and the record approach of a color ink jet printer.
[0002]
[Description of the Prior Art] Generally the color printer is holding the big technical problem that the ink which are liquids carries out color mixture mutually in ink jet record, or it flows out of piling up and printing each color of yellow, a Magenta, and cyanogen.
[0003] Then, in order to solve the above-mentioned technical problem conventionally, like JP,60-197778,A, the surface tension of the recording ink of each color which forms a color picture is within the limits of 30 - 60 dyn/cm in 20 degrees C, the fixing business time amount of the recording ink of each color to a recorded material and a blot degree are made equal by using that to which the surface tension of the recording ink of each color was equal, and the method of suppressing degradation of a color picture is proposed. However, by the approach using said record ink, the degree of a blot of a record object does not decrease and cannot become a means to improve image degradation. Moreover, in said record ink, the technical problem that a quality of printed character is inferior occurs in comparison with what twists the record object of a black color to a monochrome printer.
[0004]
[Problem(s) to be Solved by the Invention] Then, the purpose of this invention prevents the color mixture blot by the influx of the ink between black ink and color ink, and is to offer the ink set for ink jet record which can offer a sharp and clear color picture.
[0005]
[Means for Solving the Problem] The ink set for ink jet record of this invention is characterized by the movement ratio (Rf value) of the color contained in said each ink for record more than a color (N-1) being 0.5 to 0.8 among the ink for record of said N color in the ink set for ink jet record which becomes a recorded material from the ink for record of N color which forms an image.
[0006]
[Embodiment of the Invention] In this invention, it is based on selecting the color in the ink for record (black ink and color ink) combined and used paying attention to the property of the balance of each chromatography property and organic nature (hydrophobicity), and inorganic nature (hydrophilic property) in order to form a color picture. And preparing ink so that the chromatography property over the paper of each color may be specified in a certain range and adjusting ink so that a balance property may approximate mutually, and by doubling the balance property of each color with the balance property of a recorded material further, separation of the unique color in a recorded material does not arise, but said purpose is attained.
[0007] Let the value of the movement ratio (obtained by the paper chromatography method) specified below be one standard in this invention as a chromatography property of the color to be used. Moreover, let the value acquired from the count specified below as a balance property of the organic nature

(hydrophobicity) of a color, and inorganic nature (hydrophilic property) be one standard.
[0008] the color of a how [to ask for the movement ratio (Rf value) of a color] request -- water / diethylene-glycol (weight ratio; 90/10) mixed solvent -- 5wt(s)% -- it is made to dissolve and considers as test fluid. After doing 5microl charge of at the lower limit section of 20 kinds of papers which show this test fluid in Table 1, according to a conventional method, predetermined time is developed using the expansion solvent shown in Table 2. and the expansion distance (A) of the ink water from said charging point and the migration length (B) of the color from said charging point -- measuring -- both ratio -- the value of;B/A=Rf is calculated and it considers as the movement ratio of the color for this Rf value.
[0009]
[Table 1]
各被記録材の種類とＩ／Ｏ値

番号	被記録材（名称）	分類	メーカー	I/O値
1	Drescher	中質紙	Unternehmensbild-Entwurt Geschaftsdrucke	1．9
2	Conqueror	上質紙	Argo Wiggins	2．5
3	ﾔﾏﾕﾘ	中質紙	本州製紙	1．9
4	XEROX4024	上質紙	XEROX	2．4
5	XEROX D	上質紙	XEROX	2．3
6	X-offit	上質紙	Chlorfrei gebleicht	2．0
7	XEROX(ｺﾋﾟｰ)	再生紙	XEROX	2．6
8	YUPO	合成紙	王子油化	1．9
9	STEP 3	専用紙	旭硝子	1．9
10	はやぶさ	ﾎﾞﾝﾄﾞ紙	十條製紙	1．4
11	金鐘	ｸﾗﾌﾄ紙	山陽国策ﾊﾟﾙﾌﾟ	2．8
12	ｼﾙﾊﾞｰｸﾛｰﾈ	ｷｬｽﾄｺｰﾄ紙	大昭和製紙	2．7
13	三菱ﾏｯﾄｱｰﾄ	ｱｰﾄ紙	三菱製紙	1．5
14	KSﾆｭｰﾄｯﾌﾟ	ｺｰﾄ紙	神崎製紙	2．0
15	ﾋﾟｭｱｰｹﾝﾄ	ｹﾝﾄ紙	東京製紙	2．9
16	ﾌﾟﾚｽﾎﾞｰﾄﾞ	ｺﾝﾃﾞﾝｻｰ紙	三菱製紙	4．0
17	ｺﾛﾅS	特殊紙	本州製紙(麻原料紙)	3．5
18	硫酸紙	硫酸紙	王子製紙	0．5
19	OHP	OHP	XEROX	0．1
20	三菱ﾘｰﾌ	ｲﾝﾃﾞｨｱﾍﾟｰﾊﾟｰ	三菱製紙	0．8

[0010]
[Table 2]
展開溶媒の配合組成表（ｗｔ％）

構成材料	配合量
TEG-m-BE	10.0
Olfine STG	1.0
H_2O	89.0
合計	100.0

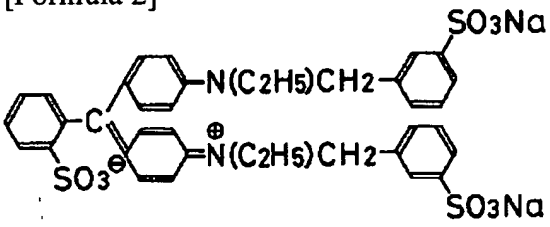
[0011] When the movement ratio (Rf value) which the color in each ink for record combined and used on the same recorded material shows to paper and an expansion solvent was from 0.5 to 0.8 according to the knowledge which this invention person etc. acquired as a result of wholeheartedly research, it found out that color bleeding stopped occurring mostly in respect of practical use.

[0012] Furthermore, when the movement ratio of two or more colors contained in each ink for record was compared and it etc. was from 0.6 to 0.8, it became clear that color bleeding also stopped occurring nearly perfectly.
[0013] Moreover, under these conditions, the osmosis rate and diffusion degree of each color ink to the same recorded material approximated mostly, and it also turned out that fine differences, such as it, are not identified visually. Therefore, when each color ink combined and used to the same recorded material overlaps the same point, faults, such as color nonuniformity and color gap, do not occur at all.
[0014] That is, when the Rf value to the paper and ink water of a color is within the limits of this value, an affinity (adsorption power) works strongly between a color and paper, and color bleeding is prevented. On the contrary, when the Rf value has separated from this range, an affinity (adsorption power) works to an ink side strongly, and a color causes bleeding generating.
[0015] Moreover, it became clear by specifying this Rf value that a water resisting property also improved in addition to bleeding.
[0016] Furthermore, it became clear that there was a correlation with the very close inorganic nature (hydrophilic property) organic nature (hydrophobicity) value (I/O value) of the color which explains this Rf value below. Therefore, when the I/O value calculated from the structure expression of a color when the Rf value of a color was not able to be calculated in an experiment can be used as a book, and a color can be prepared and the I/O value of a color cannot be calculated by count, the Rf value calculated from the chromatography method of a color can be used as a book, and a color can be prepared.
[0017] a how [to calculate the inorganic nature / organic value of a color] organic compound -- all -- description is expressed with the combination of inorganic nature and organic nature like a degree type.
[0018]
[Equation 1]
有機化合物の全性状の表わし方

[全性状] = [基本炭化水素／全分子] + [置換基／全分子] + [変態部／全分子]
↓ ↓ ↓
有機性 無機性 無機性

[0019] A hydrocarbon sets the organic value of one carbon atom to 20 as what shows perfect organic nature. Inorganic nature / organic value (I/O value) is calculable about each color from the inorganic value of this and various inorganic nature machines. It is thought that the color with the equal ratio of inorganic nature and organic nature shows the same property.
[0020] According to the knowledge which this invention person etc. acquired as a result of wholeheartedly research, an Rf value is from 0.5 to 0.8. Furthermore, when the inorganic nature / organic value of the colors in each ink for record combined and used on the same recorded material (I/O value) were calculated and there was any following one relation of six items between them etc., it found out that bleeding stopped occurring nearly perfectly in respect of practical use.
[0021] (1) The I/O value of a color is within the limits of at least 1.0 to 3.0.
(2) The difference of the I/O value of a color is less than in at least 0.6.
(3) The difference of IO value of ink water and IO value of a color excluding the color from the inside of ink is . There are 0.8 or more.
(4) The difference of the I/O value of a color and the I/O value of a recorded material is less than in at least 0.3.
(5) When a recorded material is paper (cellulose), the I/O value of a color is within the limits of at least 2.3 to 3.1.
[0022] That is, when the I/O value of a color and paper is near, an affinity (adsorption power) works strongly among both, and color bleeding is prevented. On the contrary, when the I/O value of a color is close to the I/O value of ink water, an affinity (adsorption power) works to an ink water side strongly, and a color causes bleeding generating.
[0023] Furthermore, it became clear by specifying this inorganic nature / organic value (I/O value) that a

water resisting property also improved in addition to bleeding.
[0024] When composing and preparing the color ink used by this invention, various kinds of water soluble dye which carries out coloration to cyanogen, a Magenta, yellow, and black is used. Especially, the color listed below is especially suitable in this invention. In addition, each numeric value in () appended to the color number illustrated below shows the Rf value and I/O value which were calculated by the aforementioned approach, and shows them with (the Rf value / I/O value). Moreover, in I/O value calculation, it computed based on the 13 page table written by "organic conceptual-diagram-foundation and application [-]" Yoshio Koda 1.1 inorganic-base table.
[0025] Cyanogen color [0026]
[Formula 2]



[0027] (0.79/1.30)
[0028]
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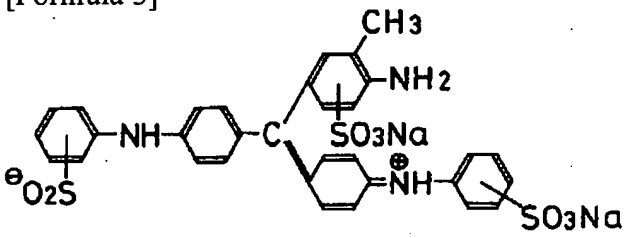

[0029] (0.60/1.62)
[0030]
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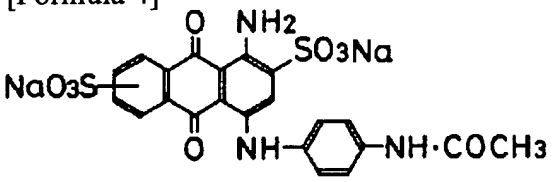

[0031] (0.51/2.33)
[0032]
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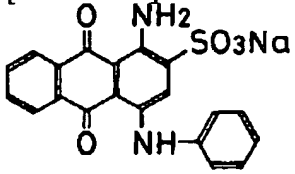

[0033] (0.51/1.60)
[0034]
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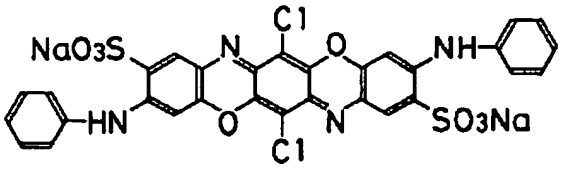

[0035] (0.69/1.57)
[0036]
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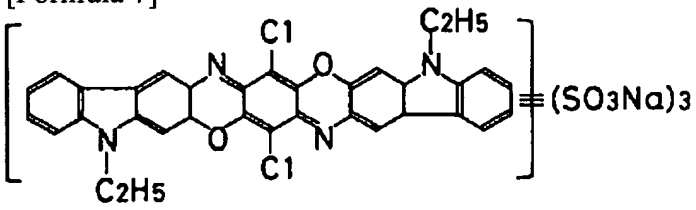

[0037] (0.76/0.94)
[0038]
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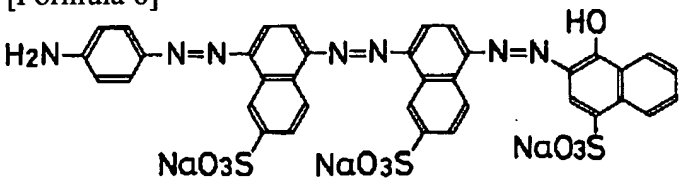

[0039] (0.67/1.67)
[0040]
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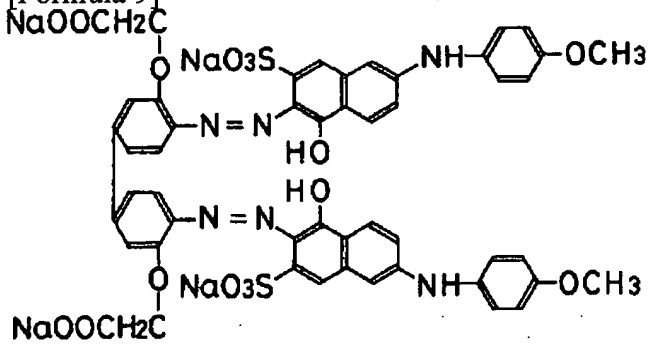

[0041] (0.70/1.50)
Magenta color [0042]
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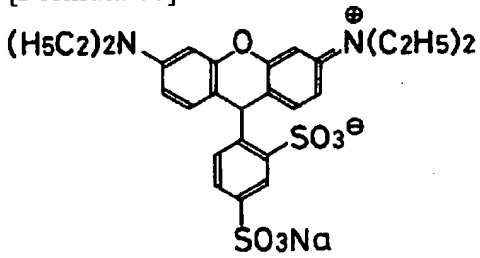

[0043] (0.71/1.32)
[0044]
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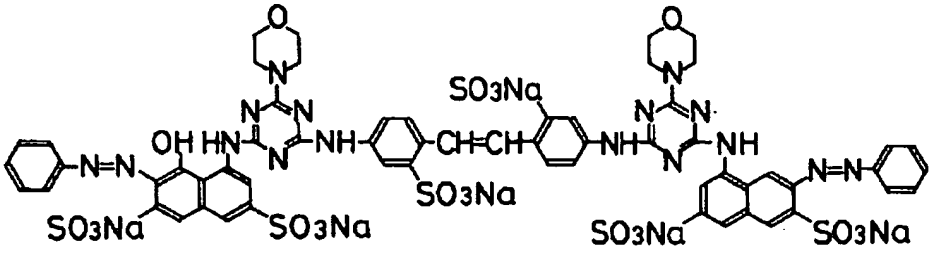

[0045] (0.67/2.31)
[0046]
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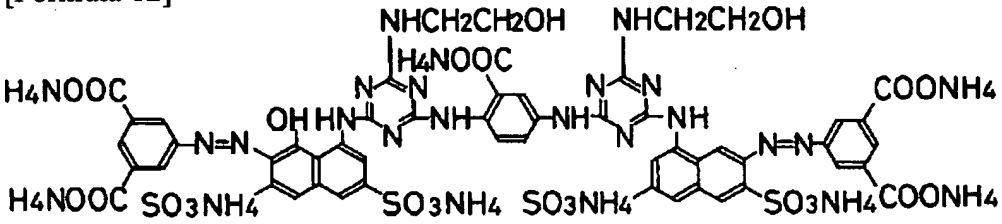

[0047] (0.68/2.97)
[0048]
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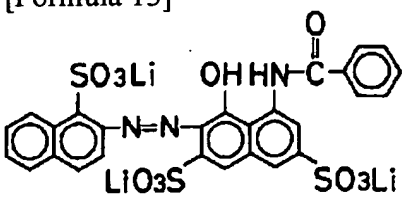

[0049] (0.59/2.10)
[0050]
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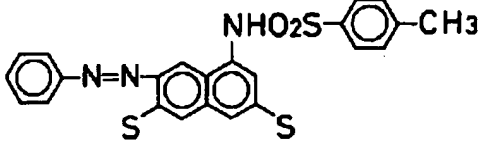

[0051] (0.75/1.87)
Yellow color [0052]
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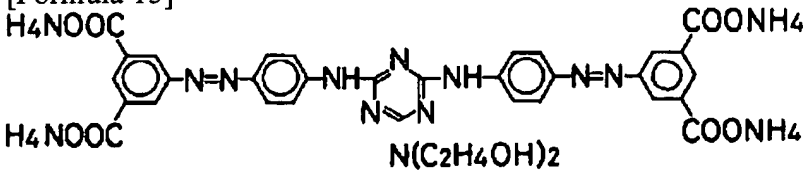

[0053] (0.63/1.94)
[0054]
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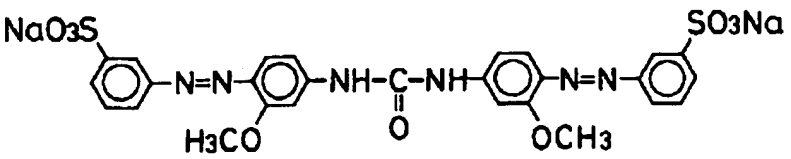

[0055] (0.63/1.60)
[0056]
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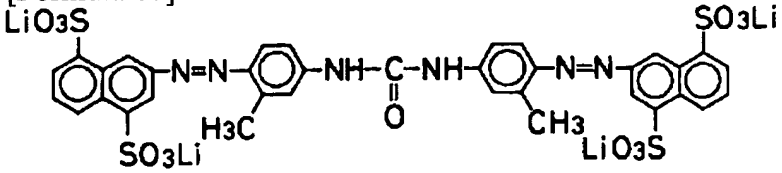

[0057] (0.80/2.02)
[0058]
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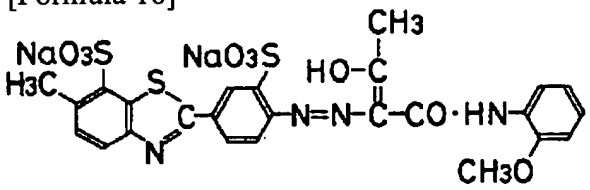

[0059] (0.75/1.79)
[0060]
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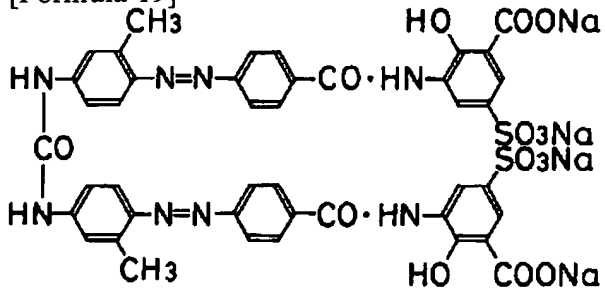

[0061] (0.67/1.89)
Black color [0062]
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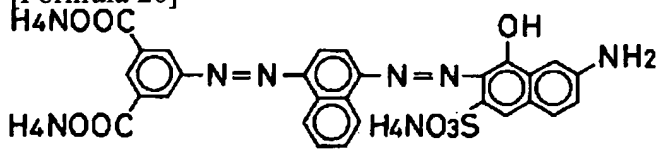

[0063] (0.67/1.63)
[0064]
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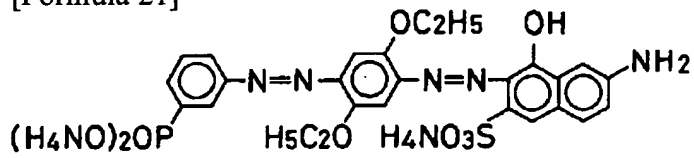

[0065] (0.72/1.63)
[0066]
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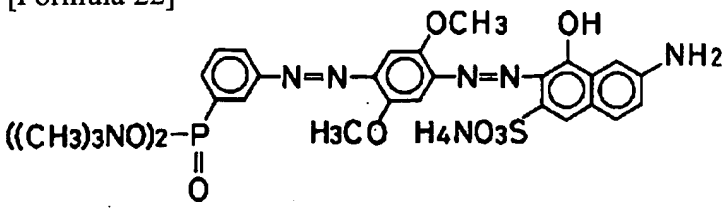

[0067] (0.61/1.42)
[0068]
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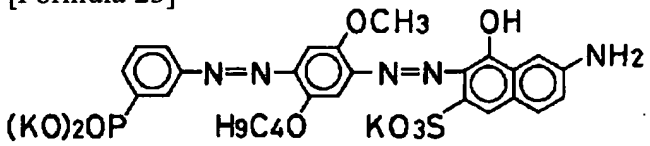

[0069] (0.68/1.57)
[0070]
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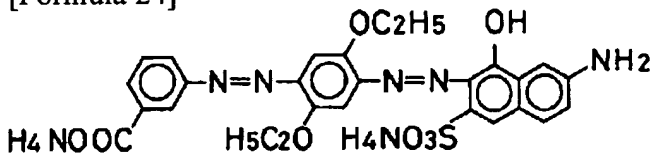
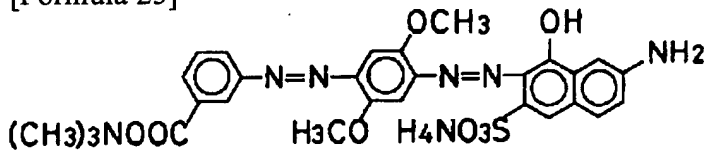


[0071] (0.69/1.41)
[0072]
[Formula 25]



[0073] (0.75/2.32) The cyanogen and the Magenta which are used for the ink set for ink jet record of this invention, yellow, and the ink for record of black consist of various additives suitable for a coloring agent, water or various organic solvents, and the purposes, such as a color described above.
[0074] It is desirable to use it in 1 to 10wt(s)% by solid content in consideration of the printing concentration of a record object, blinding, a regurgitation property, etc. as a content of these coloring agents in an ink presentation part.
[0075] The solvent used for the ink for ink jet record of this invention moreover, besides ion exchange water It is a water-soluble organic solvent. For example, methyl alcohol, ethyl alcohol, N-propyl alcohol, isopropyl alcohol, n-butyl alcohol, Alkyl alcoholic ether of the carbon numbers 1-4, such as sec-butyl alcohol, tert-butyl alcohol, and isobutyl alcohol; A dimethyl HORUMI amide, Amides, such as dimethylacetamide; Ketones, such as an acetone and diacetone alcohol, or a keto alcohol; tetrahydrofuran, Ether, such as dioxane; Polyalkylene glycols; ethylene glycol, such as a polyethylene glycol and a polypropylene glycol, Propylene glycol, 1 and 2, 6-hexane triol, thiodiglycol, alkylene glycol; in which alkylene groups, such as hexylene glycol, contain 2-6 carbon atoms -- glycerol; -- ethylene glycol methyl ether -- The low-grade alkyl ether of other ** alcohol, such as the diethylene-glycol monomethyl (or ethyl) ether and the triethylene glycol monomethyl (or ethyl) ether, is mentioned.

[0076] Also in the above water-soluble organic solvent, it is desirable from the effectiveness of

polyhydric alcohol as a desiccation inhibitor for preventing the poor regurgitation by the nozzle blinding by the water in ink jet record ink evaporating, and a record agent depositing being large.
[0077] Although it can be used even if these water-soluble organic solvents are independent, two sorts or the solvent beyond it can also be mixed and used.
[0078] Moreover, in order to satisfy both a quality of printed character and permeability in each ink of the cyanogen and the Magenta which are used for the ink set for color ink jet record of this invention, yellow, and black, it is required for it to add the surfactant of penetrating agents, such as the diethylene-glycol monobutyl ether and the triethylene glycol monobutyl ether, or ORUFIN STG, and ORUFIN E1010 grade as a penetrating agent. The permeability to the paper of ink increases by this, and it becomes effective for bleeding prevention.
[0079] In addition, in the record ink used for the ink set for color ink jet record of this invention, a well-known dispersant, a surfactant, a viscosity modifier, a surface-tension modifier, a specific resistance modifier, pH modifier, an anti-oxidant, an antifungal agent, a chelating agent, etc. can be added if needed conventionally.
[0080] Although the contents in the ink presentation part of these various additives differ according to the purpose, since an excessive amount foams and becomes causes, such as a deposit and shelf-life degradation, it is desirable to use it in 0.001 - 5wt%.
[0081]
[Example] The concrete example and the example of a comparison of this invention are used for below, and the ink set for color ink jet record of this invention is explained to it.
[0082] (Examples 1-9) After combining the color shown in the color of each color which is shown in Table 4, and which was mentioned above, and the following with the ink presentation which is to the base of each color shown in the inner table 3 and agitating the constituent of each color according to an individual, it filtered using the filter and the cyanogen ink of the examples 1-8 of this invention, Magenta ink, yellow ink, and black ink were prepared. About the example 9, it adjusted to the ink water with which the I/O value shown in Table 5 serves as a base of 1.5 as ink for record combining the color of each color shown in Table 4. Evaluation performs the following dyadic eyes and an evaluation result is shown in Table 4.
[0083]
[Table 3]

カラーインクの組成表（ｗｔ％）

構成材料	ｼｱﾝｲﾝｸ	ﾏｾﾞﾝﾀｲﾝｸ	ｲｴﾛｰｲﾝｸ	ﾌﾞﾗｯｸｲﾝｸ
ブラック染料（Ａ）	－	－	－	4.03
ブラック染料（Ｂ）	－	－	－	1.98
イエロー染料（Ａ）	－	－	1.47	2.10
イエロー染料（Ｂ）	－	－	0.93	－
マゼンタ染料（Ａ）	－	1.25	－	－
マゼンタ染料（Ｂ）	－	1.00	－	－
シアン染料（Ａ）	2.00	－	－	－
シアン染料（Ｂ）	1.50	－	－	－
ＤＥＧ－ｍ－ＢＥ	－	－	－	10.0
ＴＥＧ－ｍ－ＢＥ	10.0	10.0	10.0	－
ｵﾙﾌｨﾝＳＴＧ	0.80	－	0.80	0.80
ｵﾙﾌｨﾝＥ１０１０	－	0.80	－	－
ｸﾞﾘｾﾘﾝ	11.0	10.0	10.0	9.00
２－ﾋﾟﾛﾘﾄﾞﾝ	－	－	－	3.20
ｼﾞｴﾁﾚﾝｸﾞﾘｺｰﾙ(DEG)	9.40	9.10	12.0	－
ﾄﾘｴﾀﾉｰﾙｱﾐﾝ(TEA)	0.60	0.60	0.10	0.60
水酸化ｶﾘｳﾑ(KOH)	－	0.10	－	0.10
尿素(Urea)	－	3.50	－	－
ﾍﾞﾝｿﾞﾄﾘｱｿﾞｰﾙ(BTA)	0.01	0.01	0.01	0.01
ﾌﾟﾛｷｾﾙ（Proxel)XL-2	0.30	0.30	0.30	0.30
ＥＤＴＡ	0.02	－	－	－
H_2O	64.37	63.34	64.39	67.88
合計	100.0	100.0	100.0	100.0

[0084]
[Table 4]

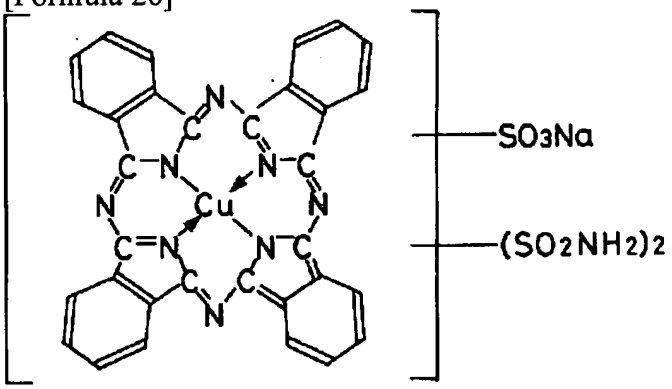
Colｲﾝｸ	実１	実２	実３	実４	実５	実６	実７	実８	実９
Bk(A)	化20	化22	化24	化32	化20	化22	化25	化25	化25
Bk(B)	化21	化23	化25	化33	化23	化23	化32	化33	化33
Ye(A)	化29	化16	化18	化19	化29	化16	化29	化29	化29
Ye(B)	化15	化17	化30	化31	化17	化30	化17	化31	化31
Mg(A)	化10	化12	化13	化10	化12	化10	化11	化12	化12
Mg(B)	化11	化28	化14	化11	化28	化14	化13	化28	化28
Cy(A)	化26	化27	化4	化6	化8	化2	化26	化26	化26
Cy(B)	化2	化3	化5	化7	化9	化3	化4	化4	化4
ﾃｽﾄ1	◎	◎	◎	◎	◎	◎	◎	◎	◎
ﾃｽﾄ2	◎	◎	◎	◎	◎	◎	◎	◎	◎
使用用紙	1～20	1～20	1～20	1～20	1～20	1～20	4, 5,	11, 15,	1～20

[0085]
[Table 5]

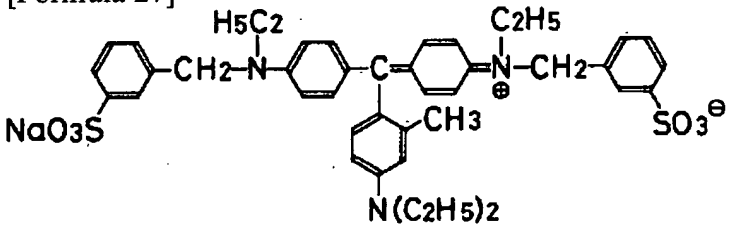
I/O 値が 1.5 のｲﾝｸ水の組成表 (wt%)

構成材料	配合比
TEG-m-BE	10.0
ｵﾙﾌｨﾝSTG	0.80
ｸﾞﾘｾﾘﾝ	10.0
DEG	10.0
TEA	0.60
KOH	0.10
BTA	0.01
Proxel XL-2	0.30
H_2O	68.19
合計	100.00

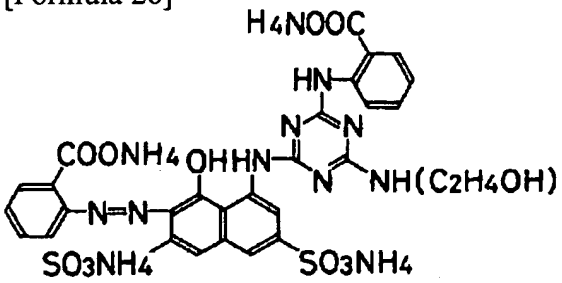
[0086]
[Formula 26]



[0087] (0.92/2.40)
[0088]
[Formula 27]

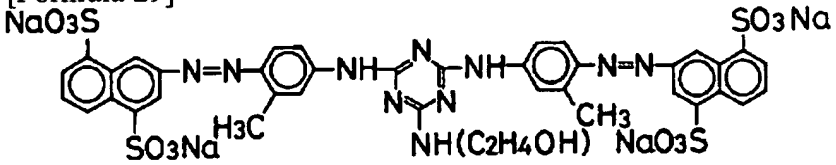


[0089] (0.49/0.93)
[0090]
[Formula 28]

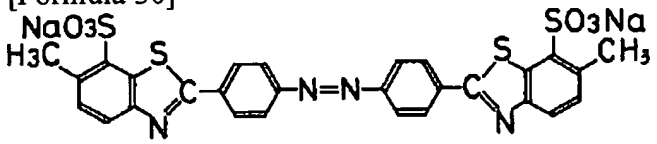


[0091] (0.87/3.08)

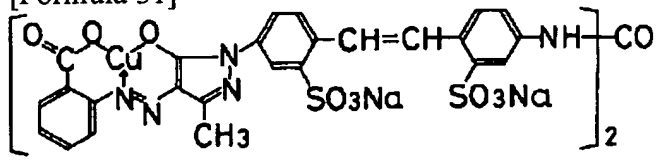
[0092]
[Formula 29]



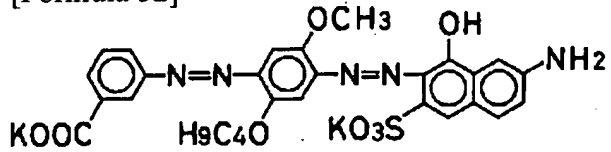
[0093] (0.88/2.42)
[0094]
[Formula 30]



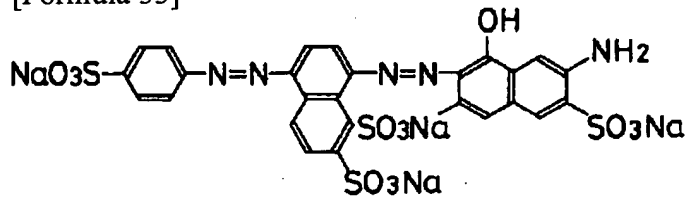
[0095] (0.45/1.34)
[0096]
[Formula 31]



[0097] (0.99/2.76)
[0098]
[Formula 32]



[0099] (0.88/2.07)
[0100]
[Formula 33]



[0101] (0.88/2.63)
[Test 1] The character and the above-mentioned cyanogen by which duty printing adjustment was carried out 100% of seven colors, 360dpi which is the experimental model equipped with piezo vibrator using a Magenta, yellow, and the ink for record of black each color, A predetermined picture signal is embraced using the on-demand mold ink jet recording device of 48 nozzles. The recorded material with which the I/O values listed to Table 1 differ respectively was made to inject, and seven colors (cyanogen, a Magenta, yellow, red, Green, blue, black) were printed to all (a character, solid). The quality of printed character of a character of obtained color printing was also good, and there is no color nonuniformity of a solid part and it has realized high quality.
[0102] The I/O value of the recorded material shown all over Table 1 applied the loadings to the I/O

value of each component of each paper, and made each sum total the I/O value of the paper. Taking the case of the case of XEROX (recycled paper) of Table 1 Naka of No. 7, the count approach is explained below. Table 6 shows the I/O value and the charge of combination of the component of XEROX (recycled paper) paper, and each ingredient.

[0103]

[Table 6]

XEROX(再生紙)の構成材料と各材料の I/O 値

	構成材料	I/O 値	配合量(wt%)
①	再生ﾊﾟﾙﾌﾟ	3.01	60.0
②	球状ｾﾙﾛｰｽ(ｾﾙﾌｧﾝGC700m、生化学工業)	2.83	20.0
③	ｶﾁｵﾝ澱粉	2.00	10.0
④	填料(軽ｶﾙ)	2.50	10.0
⑤	ｱﾙｷﾙｹﾃﾝﾀﾞｲﾏｰ（内添ｻｲｽﾞ剤)	1.00	10.0

[0104] ** I/O value x** of the loadings +** alkyl ketene dimer of I/O value x** of the loadings +** loading material (light calcium carbonate) of I/O value x** of the cation starch of loadings +** of I/O value x** of the loadings +** spherical cellulose of I/O value x** of playback pulp Loadings =3.01x0.5+2.83x0.2+2.00x0.1+2.50x0.1+1.00x0.1=2.62 [a test 2] It is based on the color mixture of black ink and yellow ink, and bleeds (image by contact).

With the ink set for color ink jet record of this invention, the blot of the image by contact by the color mixture of the black ink of the sample which printed yellow ink by duty 100% on the recorded material shown in Table 1, and printed the alphabetic character in black ink on it, and yellow ink was observed visually, and was evaluated as follows.

x: The blot is degrading the image remarkably.

**: A blot is conspicuous.

O : although a blot is seen a little, it is uninfluential in the whole image.

O : a blot is not conspicuous.

[0105] The Rf value of the color contained in the ink set of examples 1-9 and the ink for record of three or more colors is in the range of 0.5 to 0.8. And about the difference in the I/O value of each color, it was as follows.

[0106] examples 1-5 -- until -- the I/O value of a color is in the range of at least 1.0 to 3.0, and, thereby, the color bleeding of a color is suppressed.

[0107] An example 6 has the I/O value of a color in the range of 1.3 to 1.9, and the color bleeding of a color is suppressed by having gathered within the limits of this.

[0108] The example 7 shows that color bleeding is suppressed, when the I/O value of a color has the I/O value of a recorded material in the range of 1.90 to 2.70 at the time of 2.20 to 2.40. The I/O value of a color is in the range of 2.02 to 2.42, and is in this range.

[0109] Since the I/O value of paper is 2.83 when a recorded material is paper (cellulose), the example 8 shows that color bleeding is suppressed, when the I/O value of a color is in the range of at least 2.3 to 3.1. The I/O value of a color is in the range of 2.32 to 3.08.

[0110] The example 9 shows that color bleeding is suppressed for the difference of the I/O value of a color, and the I/O value of ink water by a certain thing 0.8 or more. The I/O value of a color is in the range of 2.32 to 3.08.

[0111] The penetrating agent or the surface active agent is blended with examples 1-9, and generating of color bleeding is suppressed by raising permeability.

[0112] (Examples 1-3 of a comparison) After combining the color of each color shown in Table 7 with the ink presentation which is to the base of each color shown in Table 3 and agitating the constituent of each color according to an individual, it filtered using the filter and the cyanogen ink of the examples 1-3 of a comparison of this invention, Magenta ink, yellow ink, and black ink were prepared. Evaluation

performs the same dyadic eye as an example, and an evaluation result is shown in Table 7.

[0113]

[Table 7]

Colインク	比1	比2	比3
Bk(A)	化32	化32	化32
Bk(B)	化33	化33	化33
Ye(A)	化29	化30	化29
Ye(B)	化30	化31	化31
Mg(A)	化28	化28	化28
Mg(B)	化13	化13	化14
Cy(A)	化26	化26	化27
Cy(B)	化4	化27	化5
テスト1	×	△	×
テスト2	△	×	×
使用用紙	1～20	1～20	1～20

[0114] As for the ink set for ink jet record of the examples 1-3 of a comparison, the Rf value of the color in the ink for record of two or more colors used the thing of 0.5-0.8 out of range among the ink for record of four colors, and since the affinity (adsorption power) to ink surpassed the affinity (adsorption power) to the paper of a color, generating of color bleeding broke out.

[0115]

[Effect of the Invention] According to the ink set for color ink jet record of this invention, the sharp and clear color picture which does not have the influx of the ink at the time of color mixture and a blot in four colors of black ink and color ink in the record paper is obtained the Rf value of the color contained in color ink, and by specifying the inorganic nature / organic value of color ink and a recorded material (I/O value) further.

[Translation done.]